Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 238)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -6x^5 - 3x^3 - x^2 - 5x + 10$$

$$q(x) = 10x^5 - 5x^4 - 3x^3 + 2x + 6$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$p(x) = (-6)x^5 + (0)x^4 + (-3)x^3 + (-1)x^2 + (-5)x^1 + (10)x^0$$
$$q(x) = (10)x^5 + (-5)x^4 + (-3)x^3 + (0)x^2 + (2)x^1 + (6)x^0$$
$$p(x) - q(x) = (-16)x^5 + (5)x^4 + (0)x^3 + (-1)x^2 + (-7)x^1 + (4)x^0$$
$$p(x) - q(x) = -16x^5 + 5x^4 - x^2 - 7x + 4$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -3x^2 - 8x - 4$$

$$b(x) = 2x + 7$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-3x^2$	$-8x$	-4
$2x$	$-6x^3$	$-16x^2$	$-8x$
7	$-21x^2$	$-56x$	-28

$$a(x) \cdot b(x) = -6x^3 - 16x^2 - 21x^2 - 8x - 56x - 28$$

Combine like terms.

$$a(x) \cdot b(x) = -6x^3 - 37x^2 - 64x - 28$$

3. Express $(x+1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

Polynomial Operations SOLUTION (version 238)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 3x^3 + 25x^2 + 9x + 5 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

	3	25	9	5
-8		-24	-8	-8
	3	1	1	-3

So,

$$\frac{f(x)}{g(x)} = 3x^2 + x + 1 + \frac{-3}{x+8}$$

In other words, $h(x) = 3x^2 + x + 1$ and the remainder is $R = -3$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 3x^3 + 25x^2 + 9x + 5$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (3)\cdot(-8)^3 \ + \ (25)\cdot(-8)^2 \ + \ (9)\cdot(-8) \ + \ (5) \\ &= (3)\cdot(-512) \ + \ (25)\cdot(64) \ + \ (9)\cdot(-8) \ + \ (5) \\ &= (-1536) \ + \ (1600) \ + \ (-72) \ + \ (5) \\ &= -3 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x+8$. Thus, $f(-8) = -3$.